In the Specification:

Please replace pending paragraphs at page 4, lines 8-19; and at page 10, line 12 through page 13, line 8.

At page 4, lines 8-19:

The thermal transfer rollers may be heating or cooling rollers, and may operate using hot or cold thermal transfer fluids. Generally, the thermal transfer rollers will include an outer cylindrical shell which contacts the nonwoven web or other substrate being heated or cooled, an inner cylindrical shell, and an annulus between the inner and outer cylindrical shells through which heat transfer fluid may flow. The annulus may be entirely open (free of individual channels), or may include a plurality of individual channels which carry heat transfer fluid from one end to the other of the heat transfer roller. The heat transfer roller includes a roll journal on one or both ends provided with a passage for injecting and/or removing heat transfer fluid to and from the roller. A disk-shaped chamber is provided on one or both ends of the heat transfer roller for carrying heat transfer fluid between the corresponding roll journal and the annulus.

At page 10, line 12 through page 13, line 8:

Referring to Fig. 2, a hollow passage 24 extends along a central axis of the thermal transfer roller 10, and communicates at one end with an inlet channel 26 for heat transfer fluid, which supplies fluid to the passage 24 as shown by the arrows. In the embodiment shown, the passage 24 initially carries the fluid through the center of the roller from the second end 22 to the first end 21 thereof. A first disk-shaped chamber 28 at the first end 20 of the roller is defined between inner roller wall 30, first roll journal 32, and the cylindrical annulus 16. The first disk-shaped chamber 28, which is a fluid inlet chamber, carries heat transfer fluid from the passage 24 to the annulus 16, via a cylindrical fluid entry slot 34 (Fig. 2), or a plurality of smaller, individual fluid entry openings 35 (Fig. 1) formed in the inner cylindrical shell 14. The heat transfer fluid from inlet chamber 28 passes into and through the annulus 16 as the roller 10 is rotating, sometimes at high velocity, whereupon the heat transfer fluid heats (or cools) the outer cylindrical shell 12, which in turn conducts and transfers the heat (or cooling) to a substrate. In the embodiment shown, the heat transfer fluid circulates around the annulus 16 in a spiral flow pattern via channels 18.

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The heat transfer fluid then exits the annulus 16 via a cylindrical fluid exit slot 36 (or a plurality of smaller openings 35) in the inner shell 14, and enters a second disk-shaped chamber 38, which is defined between inner roller wall 40,

second roll journal 42, and the cylindrical annulus 16. The second disk-shaped chamber 38, which is a fluid outlet chamber, carries the spent heat transfer fluid to a cylindrical exit channel 44, which is defined between the second roll journal 42 and the wall of cylindrical inlet channel 26. The exit channel 44 carries the fluid to a heating or cooling device (not shown), which heats or cools the fluid as needed, for further use via the inlet channel 26.

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Referring to Fig. 1, at least one end chamber 28 or 38 (and preferably both end chambers) is provided with a plurality of channels 46 between the passage 24 and the annulus 16. Each channel 46 has a wider end approaching the inner shell 14 and annulus 16, and a narrower end closer to the passage 24. The purpose of channels 46 is to substantially prevent the heat transfer fluid from assuming an angular or spiral flow pattern within the end chamber, particularly within the inlet chamber 28, due to rotation of the roller. Angular flow patterns in the end chambers (particularly inlet chamber 28) cause increased fluid pressure and reduce the volume of fluid delivered by a typical constant-pressure fluid pump. The tendency for angular or spiral fluid flow increases with roller velocity, causing further pressure increase and further reduction in fluid volume. By substantially reducing angular or spiral flow within the end chambers, the drop in fluid volume (and heat transfer) at higher roller velocities is substantially diminished.

The channels 46 are also designed to facilitate a substantially uniform, even discharge of fluid into cylindrical slot 34 entering the annulus 16 (Fig. 2) or into numerous smaller openings 35 entering the annulus 16 (Fig. 1). This is accomplished in part by providing channels 46 with a wider end approaching the annulus, and a narrower end approaching the passage 24. This configuration permits the channels to be immediately adjacent or very close to each other at both ends, and minimizes the amount of space not occupied by channels. By minimizing the distance between adjacent channels approaching the annulus, a substantially even fluid discharge around the circumference of the annulus is maintained.

In a preferred embodiment, the adjacent channels 46 are separated by relatively thin walls 48 which do not increase in thickness between their inner ends 50 near the passage 24 and their outer ends 52 near the annulus 16. For instance, the outer ends 52 of walls 48 may be connected by an imaginary line, which may be a circle. The imaginary line connecting the ends 52 should be occupied at least 70% by channels 46 and not more than 30% by walls 48 between the channels. Preferably, the imaginary line (defined in Fig. 1 by the inner surface of inner shell 14) will be occupied at least 80% by channels 46 and not more than 20% by walls 48, more preferably at least 90% by channels 46 and not more than 10% by thin walls 48.